Appendix A

Schematic Diagrams of Various OU 8-08 Structures

This Page Intentionally Blank

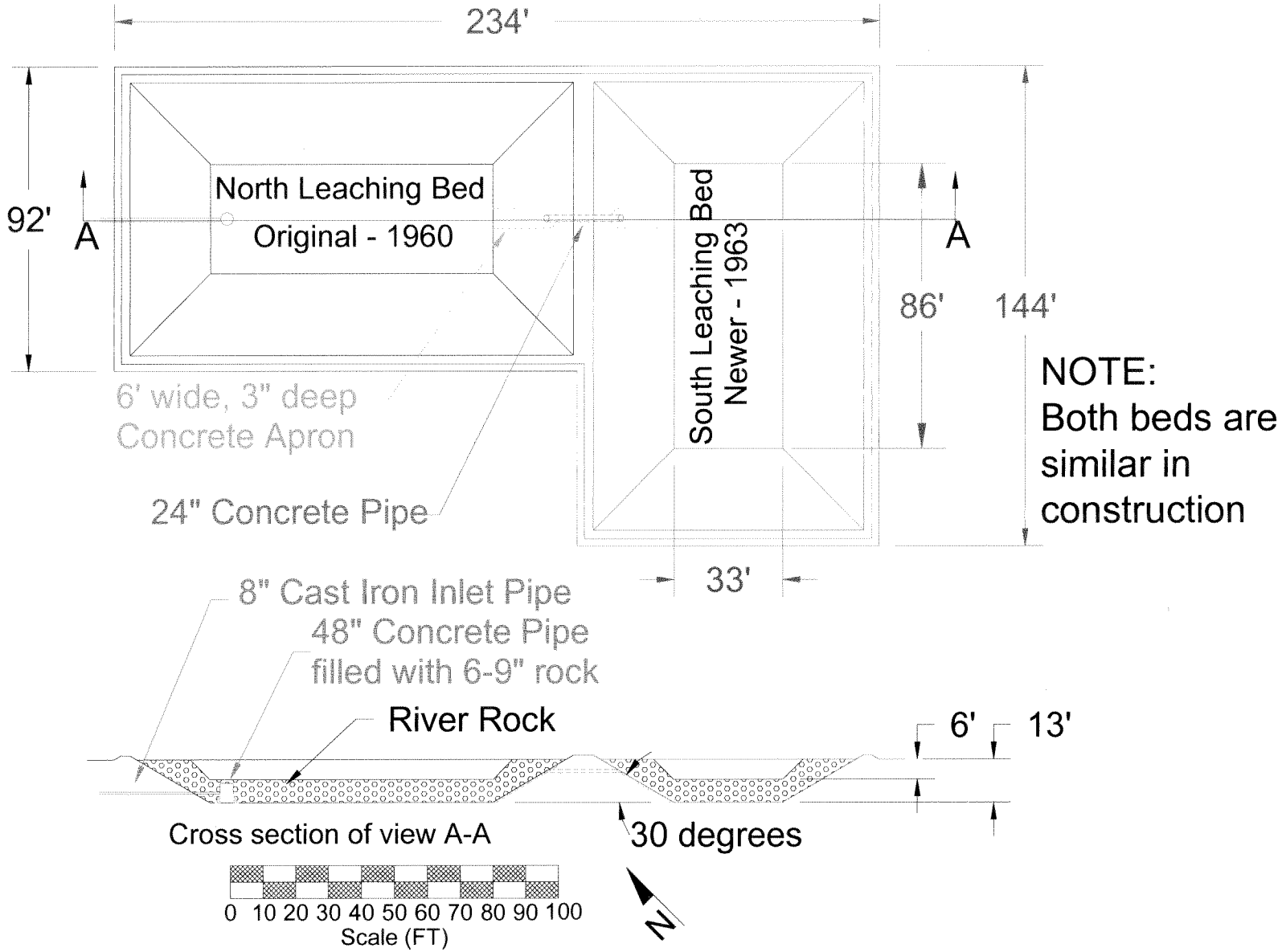


Figure A-1 Construction Drawing of S1W Leaching Beds (NRF-14)

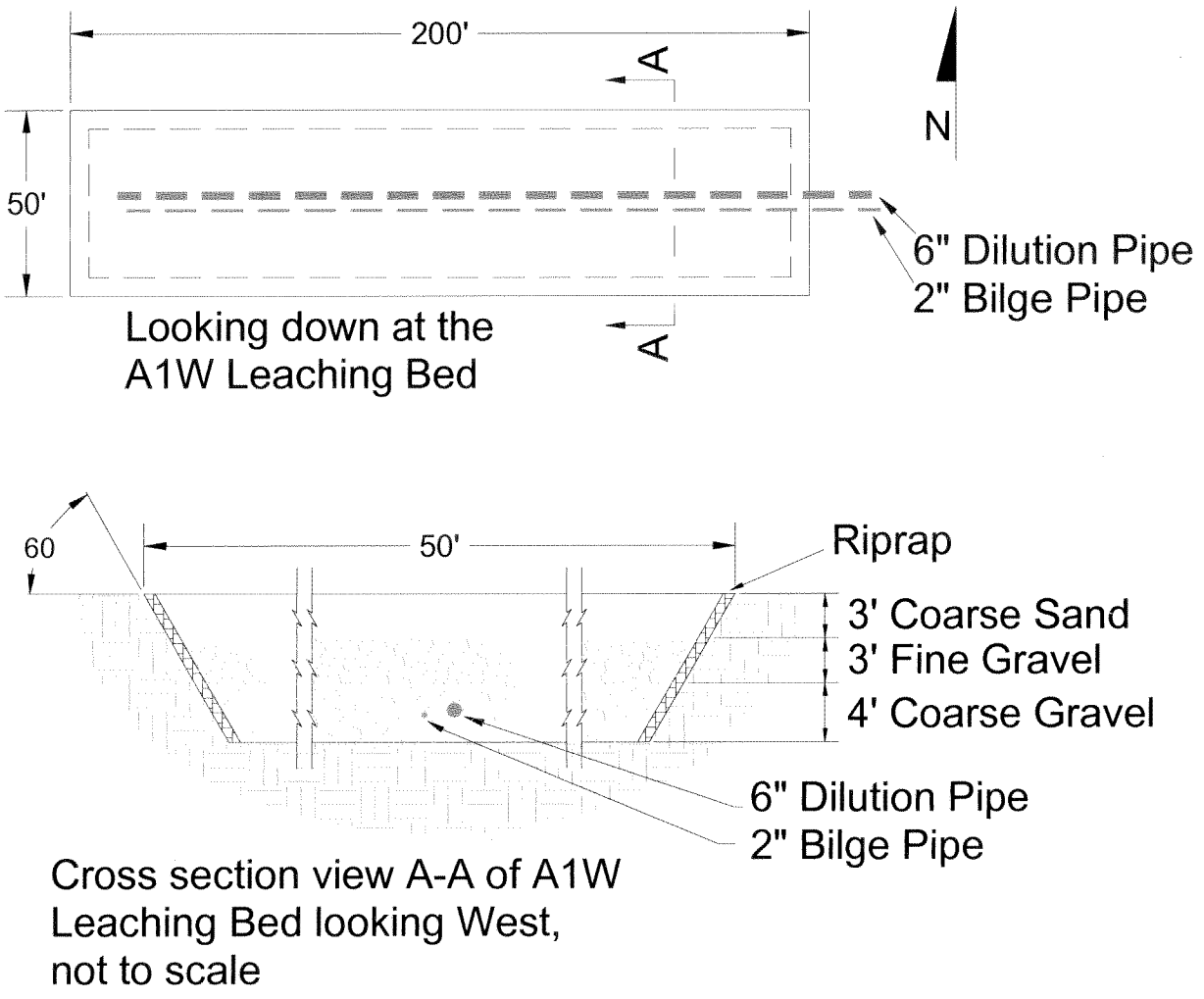


Figure A-2. Construction Schematic of A1W Leaching Bed (NRF-19)

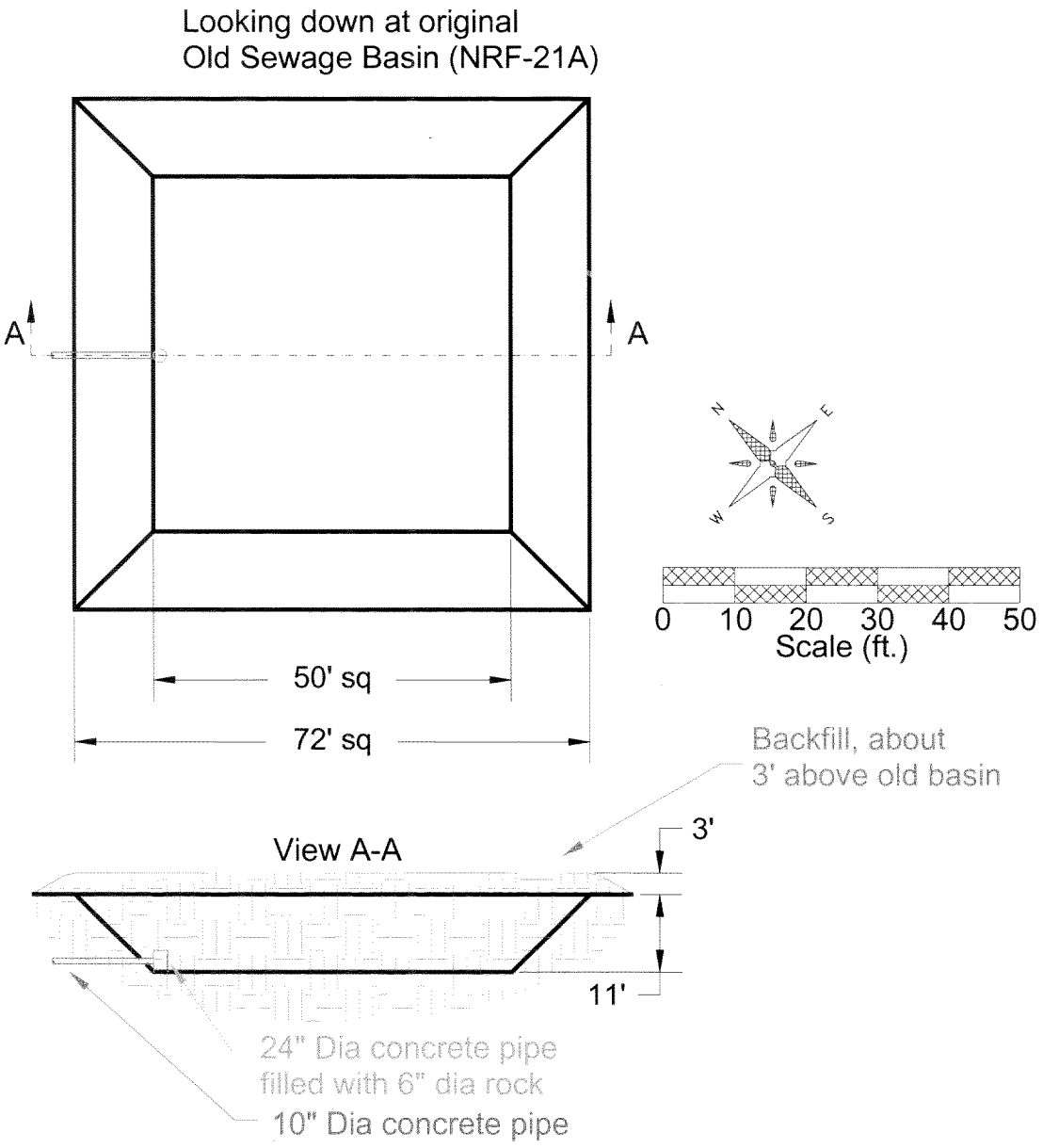


Figure A-3. Construction Schematic of the Original Old Sewage Basin (NRF-21A)

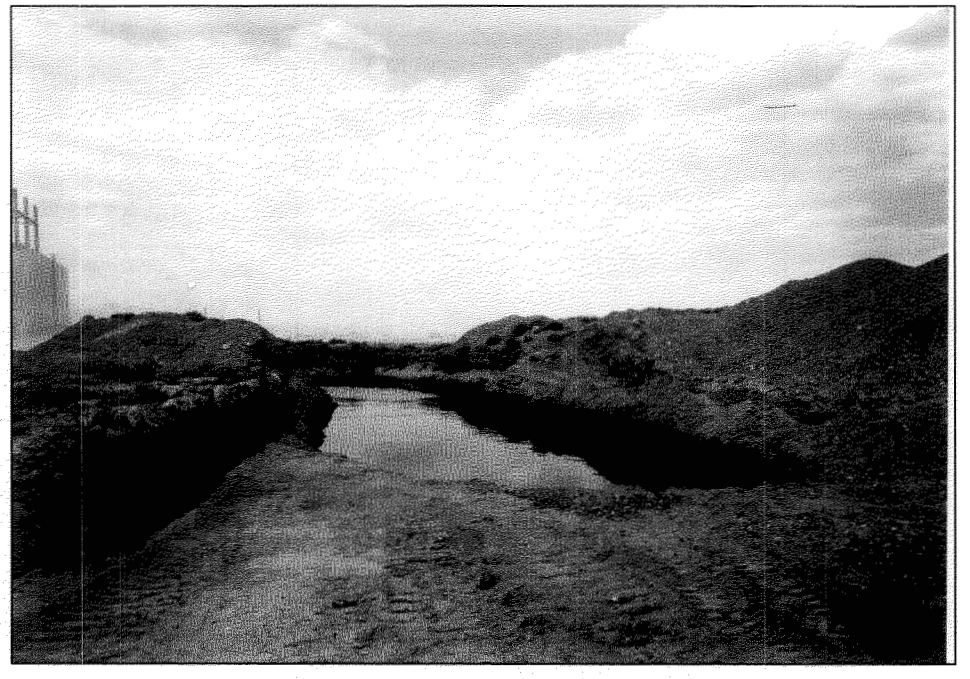
This Page Intentionally Blank

Appendix B

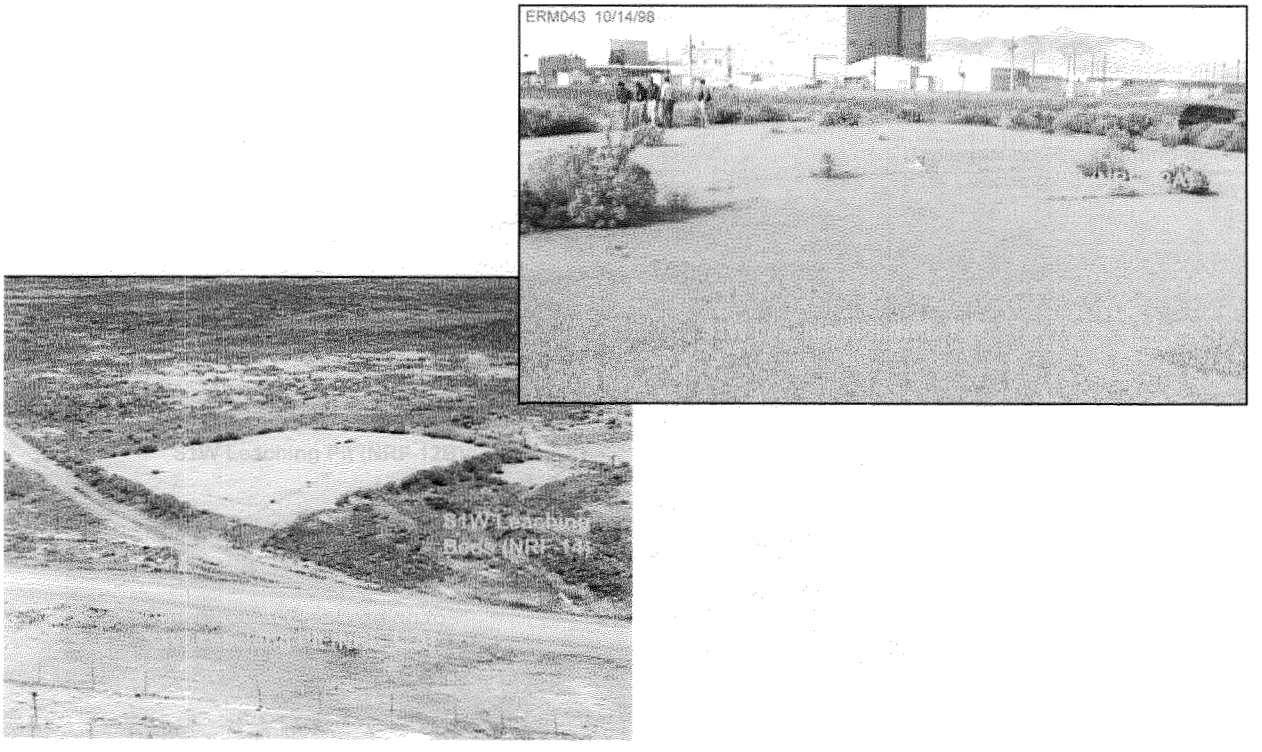
Past and Present OU 8-08 Site Photographs

This Page Intentionally Blank

S1W Leaching Pit (NRF-12B)

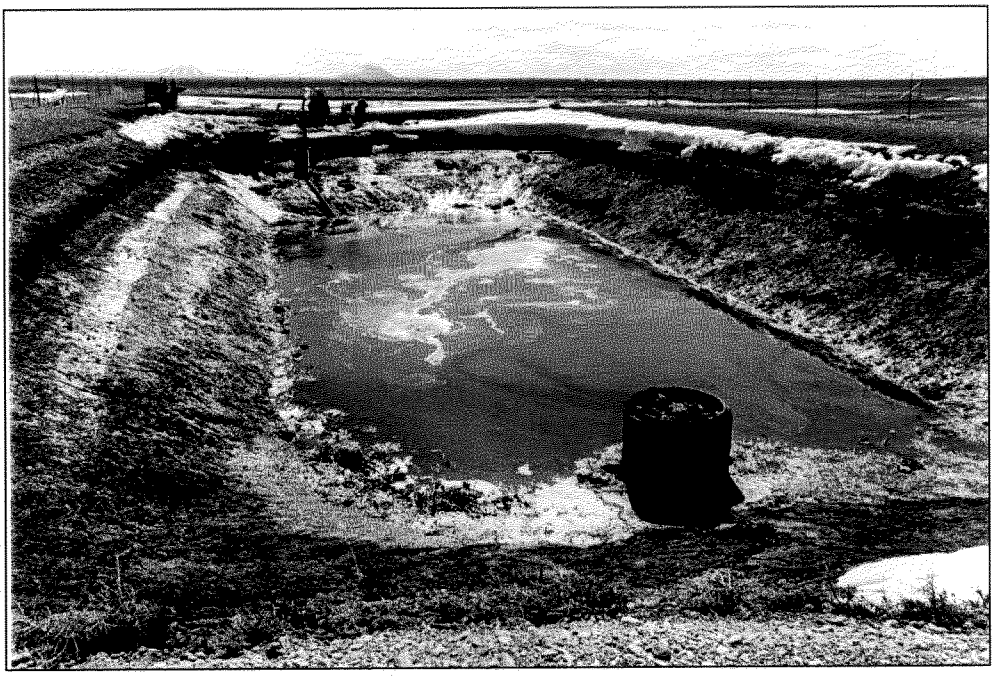


S1W Leaching Pit (NRF-12B - used from 1955 to 1961) - Photo from late 1950s



S1W Leaching Pit (NRF-12B) - 1998

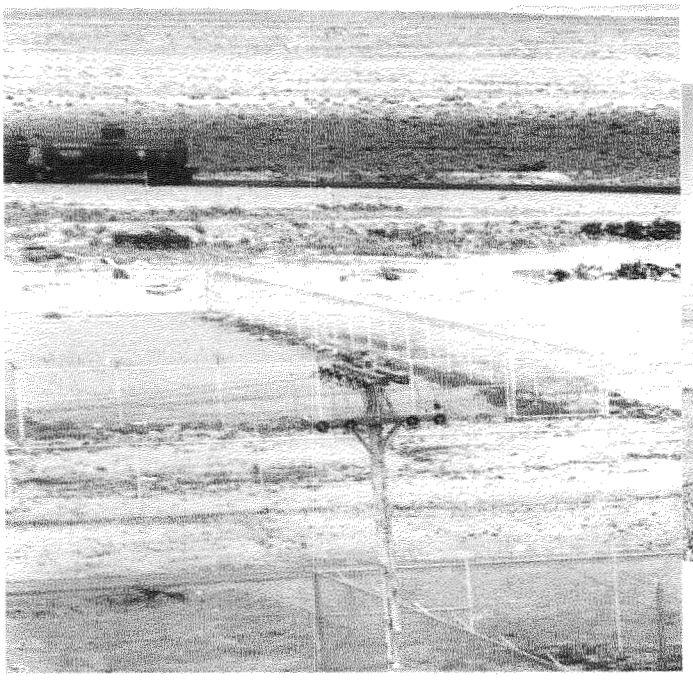
S1W Leaching Beds (NRF-14)



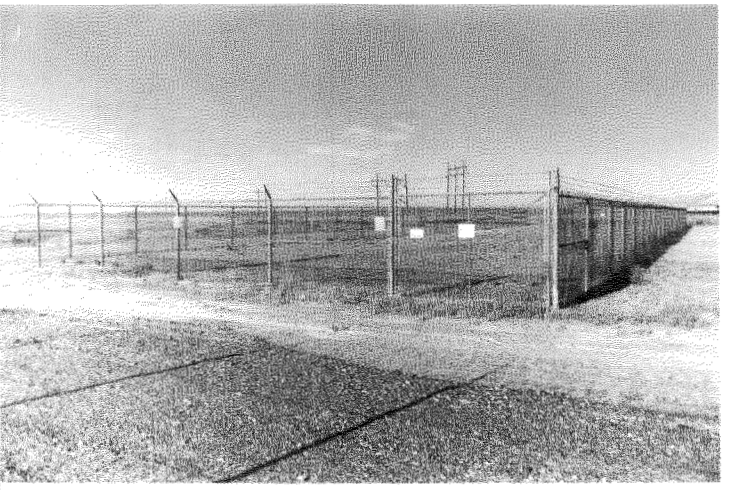
North S1W Leaching Bed (South Bed in Background)
Used from 1960 to 1979 - Photo from 1971

North S1W Leaching Bed (South Bed in Background) - 1998

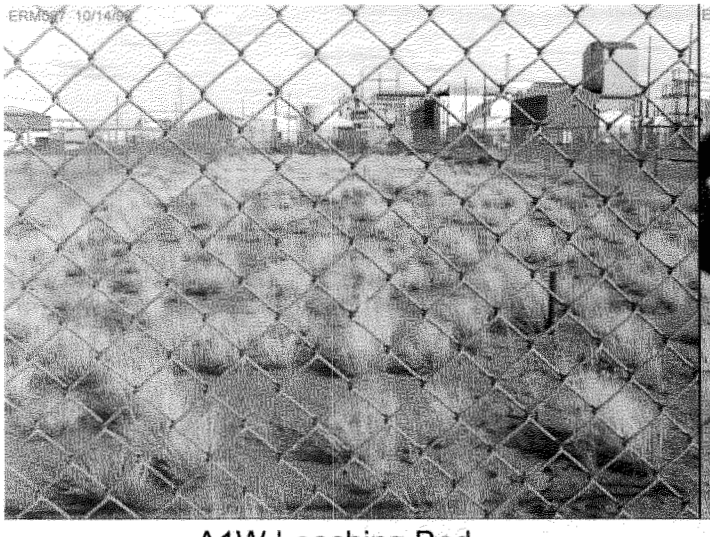
A1W Leaching Bed (NRF-19)



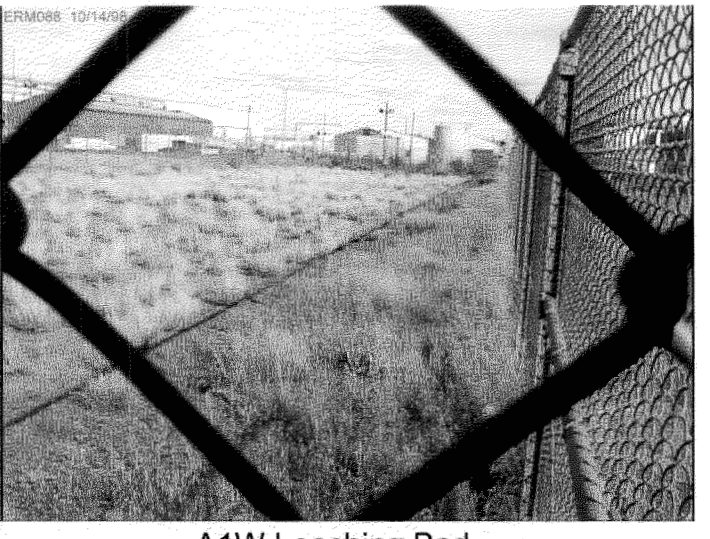
A1W Leaching Bed (Looking Northwest)
Used from 1958 to 1972
Photo from 1958



A1W Leaching Bed
(Looking Southwest) - 1986



A1W Leaching Bed
(Looking East) - 1998



A1W Leaching Bed
(Close-up - Looking Northeast) - 1998

Old Sewage Basin (NRF-21A)

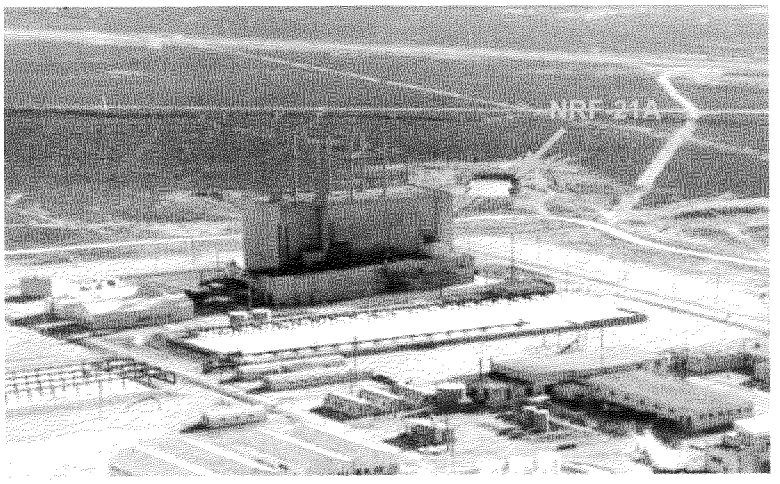


Photo of Old Sewage Basin with Expanded Basin
(in Background) - Photo from 1959

Old Sewage Basin Area - Photo from1990

Appendix C

NRF 8-08 Areas Operation and Maintenance Plan

This Page Intentionally Blank

1.0 Introduction

The NRF OU 8-08 Operation and Maintenance (O&M) Plan addresses the specific regulatory requirements for post-closure care for the designated NRF sites that include an engineered cover as the selected remedy (NRF-14, NRF-12B, NRF-19, and NRF-21A). The regulatory requirements for post-closure care include the following:

- Maintenance of the integrity and effectiveness of the final covers, including repairs as necessary to correct the effects of settling, subsidence, erosion, or other events;
- Protection and maintenance of engineered cover area surveyed benchmarks;
- Groundwater monitoring system maintenance and monitoring;
- Implementation of a surface monitoring program that provides early warning of releases of radionuclides from the sites, before they leave the site boundary; and
- Protection and maintenance of soil moisture probes.

This Operation and Maintenance Plan details the specific work activities to be performed that are associated with this remedial action project. The O&M activities consist of the following tasks:

- Annual inspection and maintenance of the engineered covers to control erosion;
- Annual inspection of groundwater wells and soil moisture probe access tubes;
- General area maintenance;
- Annual sampling of the surface soil on the engineered cover sites;
- Groundwater sampling;
- Soil Moisture Monitoring.

The location of the NRF OU 8-08 sites designated for O&M activities are depicted in Figure C-1.

2.0 General Maintenance and Inspection Plan

This maintenance and inspection plan is applicable to the engineered cover areas, the site benchmarks located within each cover area, the moisture monitoring neutron probe access tubes within each cover area, and the groundwater monitoring wells. The inspection frequency for each of these items will be on an annual basis. The following sections discuss the inspection and maintenance details.

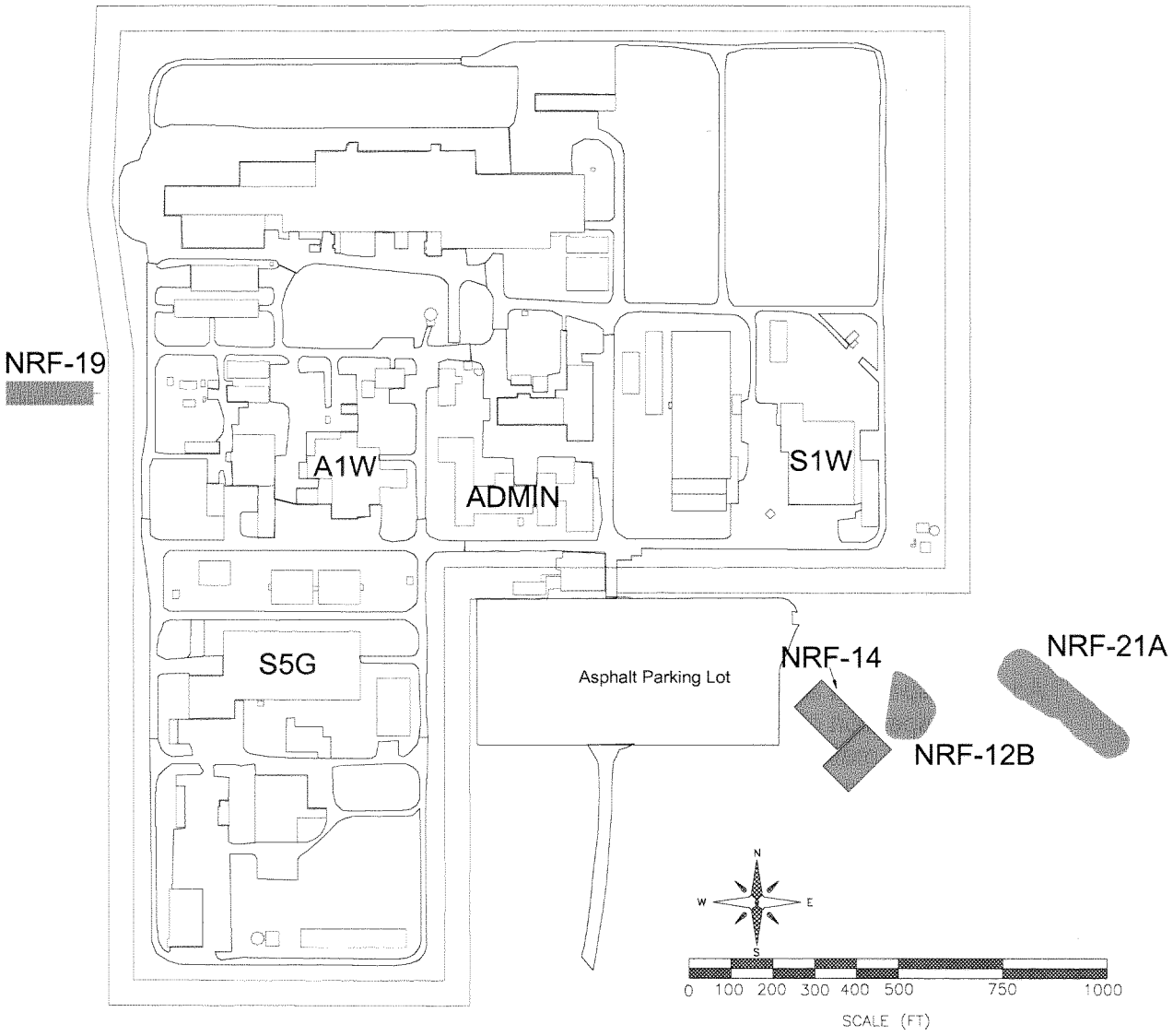


Figure C-1 OU 8-08 Site Locations Designated for O & M Tasks

2.1 Engineered Cover Area Maintenance & Inspection

The engineered covers including vegetation shall be inspected annually at least for the first five years. The frequency shall only be revised after the five-year review and with agency consensus. Results of the inspection will be recorded on an inspection form (see Attachment 1), and photographs may be taken of the areas. Elements of the site inspection are as follows:

1. Observe any areas on the cover that indicate signs of subsidence (e.g., obvious visible low spots on the cover surface where significant amounts of standing water could accumulate during major precipitation events).

2. Check for the presence of large cracks on the surface of the cover or signs of animal intrusion.

3. Observe any signs of erosion on the landfill cover (e.g., during windy conditions observe any evidence of dust blowing off of the cover, and check for erosion caused by storm-water runoff).

4. Check the condition of the vegetative cover (e.g., check for bare spots in the vegetative cover; note whether no vegetation has grown or whether the vegetation has died and has not been re-established; check for abnormal growth of weeds that may crowd out natural vegetation).

5. Check for any damage to the signs, fence, fence posts, and access gates located near or around the sites.

Observations of water run-on (from adjacent areas) to and runoff from the cover areas will be recorded and rectified by diverting the run-on source and making repairs to the areas where excessive erosion has taken place on the cover. The areas where excessive erosion has occurred will be evaluated and a determination will be made as to the cause of the erosion. An inspection of the covers will be conducted after a significant precipitation event (from thunderstorm or prolonged rain event of more than one day steady rain) to determine whether significant erosion or run-on/runoff has occurred, so that any necessary repairs can be performed as soon as practical. Re-seeding (by the seed drill method) shall be done as needed to re-establish vegetative growth. If erosion has occurred on the engineered cover, appropriate repairs will be performed such as placement of additional fill and contouring in areas where erosion has occurred and re-seeding of the repaired area. If settling and subsidence has occurred, these areas shall be repaired by placing additional fill and topsoil, contouring to the appropriate surface slope, and re-seeding with the appropriate type of vegetation. Upon discovery and assessment of any damage to the signs, fence, fence posts, and access gates located near or around the sites, appropriate repairs shall be made as soon as practical.

2.2 Site Benchmark Maintenance & Inspection

The benchmarks around the designated OU 8-08 areas shall be inspected annually at least for the first five years. The frequency shall only be revised after the five-year review and with agency consensus. Results of the inspection will be recorded on an inspection form (see Attachment 1), and photographs may be taken of the areas. Elements of the site inspection are as follows:

1. Check the condition of the brass benchmark implanted on the concrete pad. Ensure the concrete has not deteriorated around the benchmark and that the etched mark is still visible. Check for cracks on the concrete pad (monitor any minor cracks to ensure they do not widen and compromise the pad's integrity; repair as necessary).

2. Check the general condition of the bollards that encircle the benchmark concrete pad; make sure the bollards are intact (have not been knocked over by a vehicle), are painted properly, and the paint is in good condition.

Appropriate repairs shall be made as soon as possible after assessing the type of damage.

2.3 Groundwater Monitoring Well Maintenance & Inspection

A routine visual inspection of the groundwater monitoring wells will be conducted during the scheduled sampling of these locations (3 times per year). Any obvious problems will be immediately report to NRF personnel. An annual inspection shall be conducted with the results of the inspection recorded on an inspection form (see Attachment 2). Photographs of the wells and pads may be taken. The inspection frequency will only be revised after the five-year review and with agency consensus. Elements of the site inspection are as follows:

1. Check to ensure that locks are in working condition. Look for signs of corrosion and forcible entry.

2. Check the housing around the well head. Verify that it is intact, corrosion free, and undamaged. Also look for signs of forcible entry. Ensure that the lock hasp is intact and free from damage and corrosion. Look for signs of forcible entry.

3. Check electrical wiring and plug for signs of damage.

4. Check the measuring line pipe and discharge pipe for signs of corrosion. Ensure that caps are present on these two pipes.

5. Verify that the concrete pad and bollards are undamaged. Also verify that the yellow paint on the bollards in good condition.

Appropriate repairs shall be made as soon as possible after the discovery and assessment of the damage.

2.4 Moisture Monitoring Neutron Probe Access Tube Maintenance & Inspection

An inspection of the moisture monitoring neutron probe access tubes within the periphery of the engineered cover areas will be conducted annually during one of the scheduled instrument surveys at each of the locations. Site inspections that are conducted under this plan shall be recorded on a detailed site inspection checklist (see Attachment 2). Photographs may also be taken. Elements of the site inspection are as follows:

1. Check the individual access tubes for signs of damage.

2. Ensure the bollards around the access tubes are intact (have not been knocked over by a vehicle).

3. Verify that the padlocks are in working condition (not stiff when unlocking the padlock, and free of damage or corrosion). Check for signs of forcible entry.

Appropriate repairs shall be made as soon as possible after the discovery and assessment of the damage.

3.0 Surface and Moisture Monitoring Plan

Surface soil and moisture monitoring will be performed at each engineered cover location to assess the effectiveness of the cover in mitigating the release of contaminants. Surface soil monitoring will consist of gross gamma radiological surveys over the cover area, and the collection of soil and vegetation samples for radiological and chemical analysis.

Moisture monitoring will consist of measurements with neutron probes conducted via subsurface access tubes located within the cover area. Soil moisture content within the engineered cover at each site will be estimated using these measurements.

3.1 Selection Criteria for Analytes of Concern

The selection of analytes focuses on those that have been identified in previous site investigations, and those identified as contaminants of concern in the OU 8-08 Record of Decision. The specific analytical parameters of this monitoring program are listed in Table C-1. This table also indicates at which site(s) the constituents are present.

3.2 Monitoring Frequency

All engineered cover areas will be surveyed and sampled for radioactivity on an annual basis. Initially, each area will be surveyed and sampled soon after the placement of the engineered cover (to obtain baseline data), and then annually thereafter. This sampling schedule is subject to change if a problem is identified (i.e., the detection of contaminants above two times the average background, suggesting contaminant migration).

Moisture monitoring will be performed on a monthly basis for a minimum of two consecutive years, and then quarterly thereafter, at least through the initial five-year CERCLA review period. Initially, each area will be surveyed soon after the placement of the engineered cover (to obtain baseline data). The goal of this initial screening period will be to collect data from periods of excessive precipitation (wet periods), and dry periods. The two-year time frame will allow soil

moisture to stabilize after construction, and also provide ample time for the occurrence of wet and dry periods. This initial period will be useful in assessing cover performance in a recovery period after undergoing extreme drought conditions or the occurrence of a range fire when little or no vegetation is present. The duration of the initial sampling frequency may be extended based on the maturity of the vegetation cover so that more representative data can be collected.

All monitoring data collected will be evaluated in five-year CERCLA reviews, as will be the continued implementation of the long-term monitoring plan. Any decision as to whether the monitoring frequency will be adjusted will be made with agency consensus.

Table C-1 Summary of Radiological and Chemical Parameters for Soil & Vegetation Monitoring

Radionuclide/Chemical	Risk-Based Concentration	Site(s) Where Present
Radiolonuclides	**(pCi/g)**	
Americium-241	283	NRF-12B, NRF-14, NRF-19
Cesium-137	16.7	NRF-12B, NRF-14, NRF-19, NRF-21A
Neptunium-237	19.8	NRF-14, NRF-19
Nickel-63	15,846	NRF-12B, NRF-14, NRF-19, NRF-21A
Plutonium-238	590	NRF-12B, NRF-14, NRF-19
Plutonium-244	3.3	NRF-14
Strontium-90	45.6	NRF-12B, NRF-14, NRF-19, NRF-21A
Uranium-235	13.2	NRF-14
Chemical	**(mg/kg)**	
Lead	400	NRF-12B, NRF-14, NRF-19, NRF-21A

3.3 Sample Collection and Analysis

A square grid will be established at each engineered cover area. The grid will consist of individual 50 ft x 50 ft squares for Sites NRF-14/NRF-12B and NRF-21A. The grid for Site NRF-19 will consist of 20 ft x 20 ft squares. The surface soil survey and soil sampling will be conducted within this grid. The specific survey will be conducted with a measurement at each grid point. If the soil survey indicates an area of potential contamination (e.g., results greater than two times average background radiation levels), the specific survey locations will be marked, the data recorded for evaluation, and these locations selected for the collection of soil and vegetation samples. If the survey does not indicate any signs of contamination, sample

locations will be selected at random over the grid pattern. Field instrument readings from the survey will be recorded on local site radiological survey forms.

Each soil sample shall be collected at a discrete sample point within a randomly selected sample location. Each vegetation sample shall be collected within the same sample location as the soil sample as specified in the standard operating procedure (SOP). These samples will be collected in accordance with local environmental sampling SOPs. These SOPs are listed in Table C-2 with a brief description. Sampling equipment will be decontaminated after use per local environmental SOPs. The number of scan locations, and the number of samples that are to be collected at each site for each specific soil and vegetation analysis, are as follows: at Site NRF-19, a minimum of 5; at Site NRF-21A, a minimum of 10; and at Sites NRF-14 and NRF-12B combined, a minimum of 15.

The soil and vegetation samples collected from the surface of the engineered covers at the designated areas will be analyzed for radionuclides as discussed below. The surface soil survey will utilize field instrumentation for the detection of gross gamma radioactivity. The sampling and analysis program specifics for this sampling project will be included in the Facility-wide Environmental Monitoring Program. Table C-3 provides the following information: the analytical category, general sample location and frequency, sample collection procedures to be used, sample container type and size, quality control sampling for quality assurance purposes, a list of the specific constituents, the recommended analytical methods and the method quantitation limits as established by currently available standard methods (as developed by DOE, ASTM, EPA, etc.). Table C-4 provides the following information for the surface soil survey: the general sample location and frequency, instrument type, type of radiation detected, and minimum sensitivity.

The analytical methods may be updated by revision during the course of this sampling effort in which case the list of recommended analytical methods will be modified. The analytical requirements may be modified after evaluating the data collected from any sampling period. Any future modifications to the analytical requirements will be based on Agency consensus.

Table C-2. Standard Operation Procedures

Standard Operating Procedure	Description	Summary
SOP-SC-01 – Collection of Samples Using **Sample Data Sheets**	This SOP describes how all environmental samples will be collected using the appropriate Sample Data Sheet (SDS). The SDS contains the following categories for documenting pertinent information and includes the specific steps for the collection of samples: Sample Identification, Sample Collection Information, Sample Procedure, and Sample Shipment Information. After determining the type of sample to collect, the sampler will locate the appropriate SDS stated in the O&M Plan.	1. Obtain the appropriate sample data sheet specified in the O&M Plan. 2. Fill out Sample Identification section. 3. Fill out Sample Collection section. 4. Check boxes in Sample Procedure section (steps outlined in specific sample procedure as referenced below). 5. Fill out Sample Shipment section.
SOP-SC-02 – Chain of Custody Procedure	This SOP provides the requirements for the completion of the Chain of Custody Forms, which are required for all environmental field samples collected in support of the O&M phase. A Chain of Custody Form must be completed prior to the transportation of all environmental field samples unless otherwise specified. The form will be initiated by the sample technician and will accompany the sample to the point of receipt at the analytical laboratory.	1. Provide the NRF Contact (i.e., Cognizant Engineer) their telephone number and the project name 2. Make a separate entry for each sample taken, including unique sample number, date, time, and location sampled. 3. List the testing parameters to be performed on all samples that are included on this page. 4. Indicate the number of containers included for each sample. 5. Include any special observations, comments or instructions for each sample, such as handling instructions, media type, time or temperature limitations. 6. Complete the laboratory shipping information. 7. The sampler shall print his/her name, company, date, and time in the appropriate blanks, then sign the sampler signature block. 8. Each time the custody of the sample is transferred, the person relinquishing custody will sign, and provide the date and time of transfer. 9. In addition to the chain of custody receipt block, the laboratory sample custodian accepting responsibility for the sample shipment will complete the sample inventory, sign, and print their name to indicate proper receipt of the sample. 10. The laboratory will assign their own unique number for each sample.
SOP-SC-03 – Collecting Surface Soil Samples	This SOP describes the material needed and steps required to collect soil samples for environmental monitoring at NRF. This SOP applies to all soil samples collected for the monitoring purposes of soil at NRF as specified by the O&M Plan	1. Obtain proper container(s) and a clean trowel (polypropylene, Teflon, metal, or equivalent). 2. Don personal protective equipment (e.g., coveralls, disposable gloves), if necessary. 3. Using the side of a cleaned trowel, scoop the surface soil from the designated sample location onto the trowel blade. Collect sample until the sample container is completely full with soil (approximately 300 grams of sample). 4. Replace the cap on the container and screw tightly in place. Dry container, if necessary. 5. Complete the information required on the sample label and seal. Then label and seal the container. 6. Decontaminate sample equipment per appropriate SOP.
SOP-SC-04 – Collecting Vegetation Samples	This SOP describes the material needed and steps required to collect vegetation samples at NRF. This SOP applies to all vegetation samples collected for the monitoring purposes of vegetation at NRF as specified by the O&M Plan (to monitor the potential uptake of radioactivity by	1. Obtain proper container(s) and clean shears. 2. Don personal protective equipment (e.g., coveralls, disposable gloves), if necessary. 3. Using the grass shears, clip vegetation or hand pick vegetation from the designated location, placing the vegetation into the sample container. All sample material should be cut into small pieces to fit inside

Standard Operating Procedure	Description	Summary
	vegetation)	the sample container. 4. Pack all vegetation samples tightly into the container. Collect sample until the sample container is completely full with tightly compressed vegetation. 5. Decant any excess water which accumulates in the sample container during collection. 6. Replace the cap on the container and screw tightly in place. Dry container, if necessary. 7. Complete the information required on the sample label and seal. Then label and seal the container. 8. Decontaminate sample equipment per appropriate SOP.
SOP-DP-01 – Sample Equipment Chemical Decontamination	This SOP describes the chemical decontamination procedures to be followed when cleaning sampling equipment. These decontamination procedures are applicable when decontaminating any device used to obtain samples of soil or vegetation. All reusable equipment will be decontaminated after use and, when practical, before use. Also, whenever possible, disposable equipment and containers will be used to minimize field decontamination requirements, thus saving time and money, reducing the potential for cross contamination, and minimizing the waste detergent solutions that require disposal.	1. Remove bulky material from the equipment with tap water and rinse with pressurized (e.g., squirt bottle) or gravity flow deionized (DI) water. Nylon scrub brushes or wire brushes may help in removal of material. 2. Wash and scrub the equipment thoroughly with a non-phosphate detergent (such as Alconox) and DI water. Disposal of soap solution shall be in accordance with the NRF Waste Management Plan. 3. Rinse the equipment thoroughly with DI water. 4. Check sampling equipment for any particles adhering to the side; use pressurized water and, if necessary, a brush to dislodge any particles.
USGS Groundwater Sample Collection Procedures	This procedure describes the materials needed and steps required to evacuate the standing water in the well casing prior to actual sample collection and the collection of groundwater samples.	1. The sample collector shall don appropriate personal protective equipment (e.g., coveralls, disposable gloves) and stand in a position where neither the sample nor the collector becomes contaminated. 2. A volume of water equivalent to a minimum of 3 wellbore volumes is pumped from each well. 3. As the water is being pumped from the well, temperature, specific conductance, and pH are monitored. When these measurements have stabilized, a water sample is collected as follows; 4. For filtered samples, a peristaltic pump is to be used to supply an uncontaminated full-column flow of sample water to a filter apparatus (an acrylic holder with a 0.45 micron filter); the filter then drains to the sample container. 5. For unfiltered samples, a grab sample is collected from the discharge port on the sampling apparatus attached to the well (where the sample container is placed below the discharge port and sample water is collected in the container and loosely capped). 6. Appropriate preservatives are added and the samples are tightly capped, labeled, and sealed. Samples are then chilled and temporarily stored in a secured area until they are shipped. 7. All equipment is decontaminated with DI water and, if necessary, organic-free water.

Table C-3. Soil Monitoring Sampling Matrix[1]

Sample Name Media/Matrix	Sample Collection			QA Samples	Sample Analyses			
	Location(s) & Frequency	SOP #[5] SDS #	Container	Type[2]	Analyte (Synonym)	Analytical Method[3]	Holding Time	SQL[4] (pCi/g)
Radioactivity Soil and Vegetation	8-08 Engineered Cover Areas[6] Annual	SOP-SC-01, 02, 03,& 04 SDS-SOL-1, VEG-1[5]	120 mL glass for soil 1 L for vegetation	Dupl Matrix	Cesium-137	DOE HASL 300	None	1
Radioactivity Soil and Vegetation	8-08 Engineered Cover Areas[6] Annual	SOP SC-01, 02, 03,& 04 SDS-SOL-1, VEG-1[5]	120 mL glass for soil 1 L for vegetation	Dupl Matrix	Nickel-63	DOE RESL Ni-1	None	1
					Strontium-90	EPA 905	None	1
Radioactivity Soil and Vegetation	8-08 Engineered Cover Areas[6] Annual	SOP SC-01, 02, 03,& 04 SDS-SOL-1, VEG-1[5]	120 mL glass for soil 1 L for vegetation	Dupl Matrix	Americium-241[6]	DOE HASL 300	None	1
					Neptunium-237[6]	DOE HASL 300	None	1
					Plutonium-238[6]	DOE HASL 300	None	1
					Plutonium-244[6]	DOE HASL 300	None	1
					Uranium-235[6]	DOE HASL 300	None	1
Radioactivity Soil and Vegetation	8-08 Engineered Cover Areas[6] Annual	SOP SC-01, 02, 03,& 04 SDS-SOL-1, VEG-1[5]	120 mL glass for soil 1 L for vegetation	Dupl Matrix	Lead	6010	28 days	1

Footnotes:

(1) Sample size, container, preservative, and holding time may vary depending upon laboratory specific requirements.

(2) Dupl= duplicate sample;

(3) Samples are analyzed using available standard analytical methods and all included references except where noted.

(4) Sample Quantitation Limits (SQLs) or reporting limit may vary depending on analytical method and volume of sample. The SQL is the lowest activity that can be detected and reliably repeated.

(5) Soil and vegetation is to be sampled using NRF accepted SOPs and data books.

(6) These constituents will be collected only if other radionuclides are detected (i.e., strontium-90, cesium-137, nickel-63).

Table C-4. Soil Survey Sampling Matrix

Sample Program	Sample Collection			
	Location(s) & Frequency	Type of Radiation Detected	Instrument Type[1]	Minimum Sensitivity (Counts per Minute)
Surface Soil Survey	Engineered Cover Areas Annual	Beta emitters	E-140N	100
		Gamma emitters	PRM-5N SPA-3	100
		Alpha emitters	AN/PDR-56	100

Footnotes:

(1) Or most current instrument. Instrument brand name may vary but will have the same type of detector.

3.4 Moisture Monitoring Data Acquisition

An additional parameter that will be monitored for assessing the effectiveness of the engineered cover is soil moisture content. Soil moisture content within the engineered cover can be estimated by neutron scattering measurements. Soil moisture monitoring data will be acquired through the entire length of the access tube (the depth interval that includes the bottom of the cover to the surface) using a neutron probe (similar to equipment that is typically used by the agricultural and oil industry) that will be lowered into access tubes located within the cover area. The location of the access tubes within the cover areas are depicted in Figure C-2. A log of neutron scattering measurements within the cover profile will be recorded (consisting of a continous reading from the bottom of the cover to the surface). From the data collected, an estimate of soil moisture content within the soil profile (soil moisture content versus depth displayed on a chart with depth gridlines of 0.2 ft increments) will be generated, to monitor percolation of water from precipitation through the engineered covers. The data will allow comparison of monitored actual infiltration to predicted infiltration developed during the design phase. The data can also be used to help determine whether a breakthrough condition (moisture reaching the bottom of the cover) exits or is about to occur by observing the depth of the wetting front on the soil moisture profile generated.

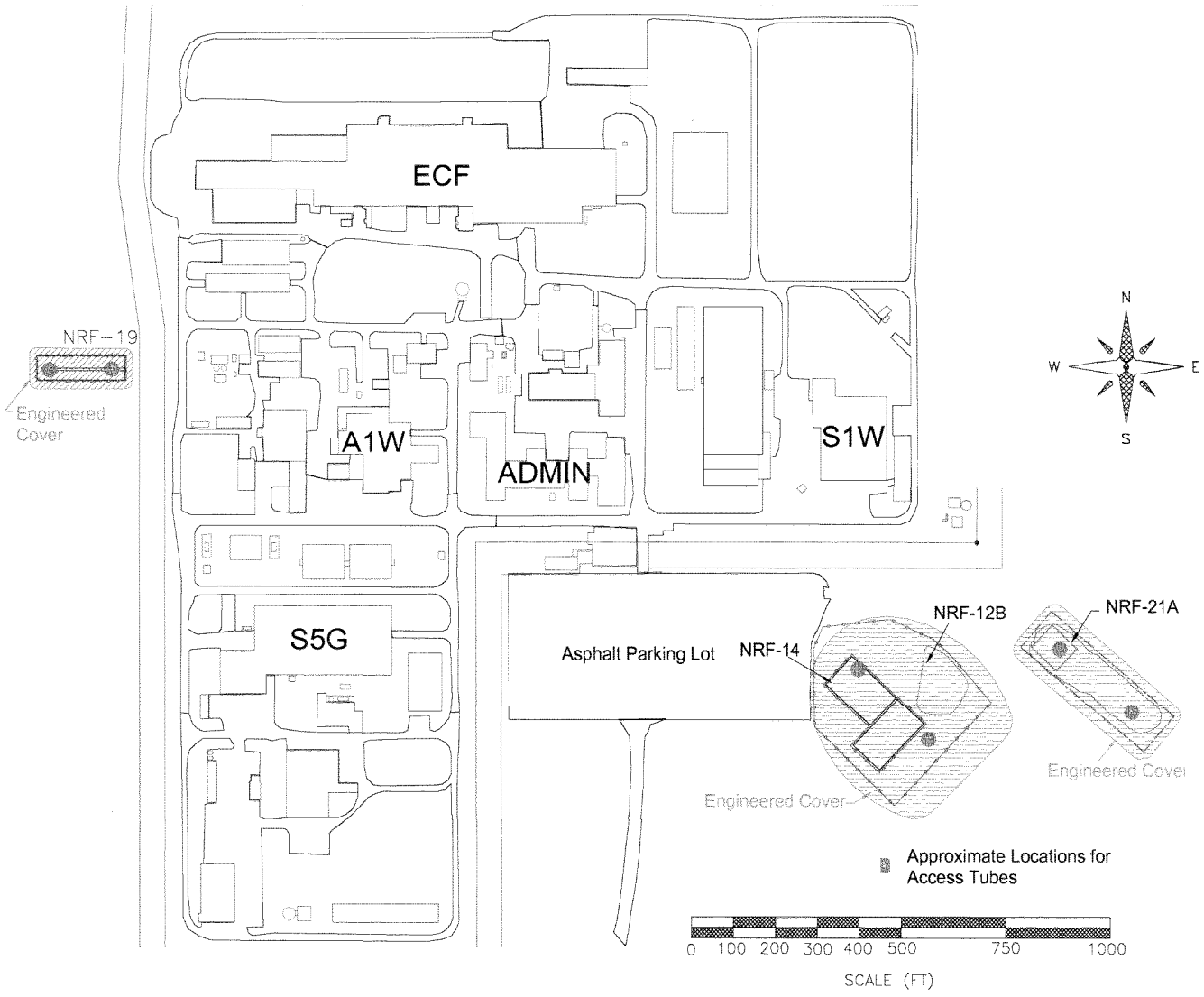


Figure C-2 Access Tube Locations

4.0 Engineered Cover Area Groundwater Monitoring Plan

Groundwater monitoring at NRF is performed to accomplish three purposes:

1. To assess overall impacts of NRF operations on groundwater,

2. To demonstrate compliance with the Land Application permit for the NRF Industrial Waste Ditch, and

3. To assess the effectiveness of the remediation actions undertaken at designated sites within NRF (inactive landfill sites and the designated NRF OU 8-08 radiological sites) in mitigating potential releases to the aquifer.

This section discusses the monitoring plan specific to the designated OU 8-08 engineered cover areas. The Facility-wide Environmental Monitoring Program will be modified to accommodate the monitoring requirements for the designated OU 8-08 areas as specified herein.

To accomplish monitoring associated with the designated areas for the OU 8-08 remedial action, groundwater samples and other pertinent data (e.g., water level, temperature, and pH measurements) will be obtained from existing monitoring wells upgradient and downgradient of the NRF designated areas. Groundwater samples and pertinent data from these wells will be obtained using USGS standard operating procedures and at a frequency identified herein.

4.1 Selection Criteria for Analytes of Concern

The OU 8-08 Groundwater Monitoring Plan requires obtaining analytical data from groundwater downgradient of the sites, and comparing it to analytical data from groundwater upgradient of the sites that represents background water quality, to determine whether these designated areas have had any impact on the aquifer groundwater quality. The specific analytical parameters for this monitoring plan are listed in Table C-5.

The identification of analytes to be monitored focuses on those that have been identified as primary constituents of concern in the 8-08 ROD. Tritium was included as it is a groundwater contaminant that is known to emanate from the S1W Leaching Beds. In the past, NRF has been able to identify and track a plume that originates beneath the leaching beds and spreads downgradient a short distance. The concentration of tritium in the downgradient wells has been well below Federal Drinking Water guidelines; however, because tritium is a good tracer/indicator, it is valuable in predicting groundwater movement and forecasting the possible presence of other radionuclides. Based on this information, only selected radionuclides, including tritium, and lead were included in Table C-5 for the 8-08 Groundwater Monitoring Plan. Other constituents (i.e., organic and inorganic constituents) are currently being monitored under the overall NRF Groundwater Monitoring Program, as described in Section 4.2.

Table C-5 Summary of Radiological and Chemical Parameters for Groundwater Monitoring

Chemical Constituent	MCL
Chemical	(µg/L)
Lead	15
Radionuclides	(pCi/L)
*Americium-241	NA
Cesium-137	NA
*Neptunium-237	NA
Nickel-63	NA
*Plutonium-238	NA
*Plutonium-244	NA
Strontium-90	8
*Uranium-235	NA
Tritium	20,000

Notes

MCL - Maximum Contaminant Level (as established by National Primary Drinking Water Regulations 40 CFR 141 and 143)

* These constituents will be collected if evidence of migration is determined to be present.

4.1.1 Field Parameter Measurements

As part of routine environmental monitoring, field measurements of specific parameters will also be performed. These parameters include water level, pH, temperature, and specific conductance.

4.2 Monitoring Frequency

Currently, the groundwater monitoring wells are sampled on a quarterly basis for metals, salts, nutrients, and radionuclides, and annually for organic compounds. In February 2001, NRF issued a CERCLA Five-Year Review for the NRF Inactive Landfill Areas. The purpose of the Five-Year Review was to evaluate the effectiveness of the remedies selected and to determine if the remedies remain protective of human health and the environment. Since the ROD for the NRF Inactive Landfill Areas specified that monitoring of the aquifer would be performed, this Five-year Review reevaluated the current NRF Groundwater Monitoring network. Sampling frequency was one aspect of the monitoring network that was reviewed.

The Five-Year Review recommended that the current schedule be maintained through 2002 and in 2003 to begin collecting samples 3 times per year (keeping organic sampling once per year). The change will result in cost savings to the government, while gathering sufficient data to correctly evaluate the potential impact that NRF operations may have on the aquifer. This sample collection frequency will also be sufficient to ascertain the effects of seasonal fluctuations. The sampling schedule may be temporarily augmented by NRF to support studies to determine causes of fluctuations. Further, permanent alterations in sampling frequency will be accomplished with Agency consensus.

Hence, groundwater monitoring following completion of OU 8-08 engineered cover construction will be three times per year for the parameters of interest, until approved otherwise by the Agencies.

4.3 Sample Collection and Analysis

Groundwater samples will be collected from designated groundwater wells as depicted on Figure C-3. These samples will be collected as specified in accordance with standard local environmental sampling procedures, including decontamination of sampling equipment after use.

The groundwater samples collected from the sampling effort associated with OU 8-08 sites will be analyzed for radiological constituents and lead (the Facility-wide Environmental Monitoring Program presently conducts the analysis for inorganic compounds, which includes lead). Analysis for nickel-63 will be performed initially. An evaluation of the data will determine whether to continue this radionuclide-specific analysis (i.e. at the 5-year review). Analyses for the specific alpha emitting radionuclides will be performed only if other more prevalent indicator constituents (i.e., strontium-90, cesium-137 etc.) are detected. The sampling and analysis program specifics for this sampling project will be included in the Facility-wide Environmental Monitoring Program. Table C-6 provides the following information: the analytical category for the specific sample type, general sample location and frequency, sample collection procedures to be used, sample container type and size, holding times, quality control sampling for quality assurance purposes, a list of the specific constituents, the currently recommended analytical methods (including the minimum detectable activity) as established by available standard methods (as developed by DOE, ASTM, EPA, etc.).

4.4 Statistical Analysis of the Data

The primary statistical method to be used in evaluating groundwater monitoring data among monitoring wells and between monitoring well groupings (i.e., upgradient and downgradient wells) is the parametric analysis of variance (ANOVA). This is the same method used in the previous NRF Industrial Waste Ditch Remedial Investigation. ANOVA will be performed to determine whether or not the compared means are equal, to identify statistically significant evidence of contamination. In cases where the means are significantly different, the ANOVA will be followed by the Tukey test to evaluate the difference(s) between the means. The Tukey test is a multiple comparison test where the sample means of several data sets are statistically compared. Throughout this statistical analysis, the parametric method assumes that the data are normally distributed. In addition, comparisons between MCLs and mean values attained in the field may be performed. Annual and seasonal trend analyses may also be performed after the first year of data collection.

If the data exhibits a pattern other than a normal distribution, the cause of this deviation from normality will be investigated. Often, data containing many "less than MDL" values results in a lognormal distribution, as is common in environmental monitoring data sets.

Table C-6. Groundwater Sampling Matrix[1]

Sample Name Media/Matrix	Sample Collection				QA Samples	Sample Analyses				
	Location(s) & Frequency	SOP #[6]	Sample Size	Container	Type[2]	Analyte (Synonym)	Analytical Method[3]	Holding Time	SQL[4] (pCi/L)	MCL[5] (pCi/L)
Total Metals Liquid	*Groundwater* aquifer monitoring wells Trimesterly	USGS SOP	1 L	*Plastic or glass*	Dupl Fld Bk	Lead	6020	6 months	0.003 mg/L	0.015 mg/L
Radioactivity Liquid	Groundwater aquifer monitoring wells Trimesterly	USGS SOP	1 L	Plastic or glass	Dupl Fld Bk	Cesium-137	EPA 901.1	None	Analyte dependent	(7)
Radioactivity Liquid	Groundwater aquifer monitoring wells Trimesterly	USGS SOP	1 L	Plastic or glass	Dupl Fld Bk	Nickel-63	DOE RESL Ni-1	None	1	(7)
						Strontium-90	EPA 905.0	None	1	8
Radioactivity Liquid	Groundwater aquifer monitoring wells Trimesterly	USGS SOP	1 L	Plastic or glass	Dupl Fld Bk	Tritium	EPA 906.0	None	30	$2X10^6$
Radioactivity Liquid	Groundwater aquifer monitoring wells Trimesterly	USGS SOP	1 L	Plastic or glass	Dupl Fld Bk	Gross Beta	EPA 900.0	None	5	15
Radioactivity Liquid	Groundwater aquifer monitoring wells Trimesterly	USGS SOP	1 L	Plastic or glass	Dupl Fld Bk	Americium-241[8]	DOE EML HASL 300	None	1	(7)
						Neptunium-237[8]	DOE EML HASL 300	None	1	(7)
						Plutonium-238[8]	DOE EML HASL 300	None	1	(7)
						Plutonium-244[8]	DOE EML HASL 300	None	1	(7)
						Uranium-235[8]	DOE EML HASL 300	None	1	(7)

Footnotes:

(1) Dark division lines indicate separate samples. Sample size, container, preservative, and holding time may vary depending upon laboratory specific requirements.
(2) *Dupl= duplicate sample; Fld Bk= field blank.*
(3) Ground-Water Monitoring Well samples are analyzed using EPA analytical methods and all included references except where noted.
(4) Sample Quantitation Limit (SQLs) may vary depending on analytical method and sample matrix.
(5) Minimum concentration levels (MCLs) are derived from drinking water regulations (40 CFR 141 and 143) unless otherwise stated and are to be used for comparison only.
(6) Ground-Water Monitoring Wells are to be sampled using USGS SOPs (contained in an internal use document),Environmental Monitoring Program SOPs, and data books.
(7) *Not determined.*
(8) These constituents will be collected only if other radionuclides are detected (i.e., strontium-90, cesium-137, nickel-63).

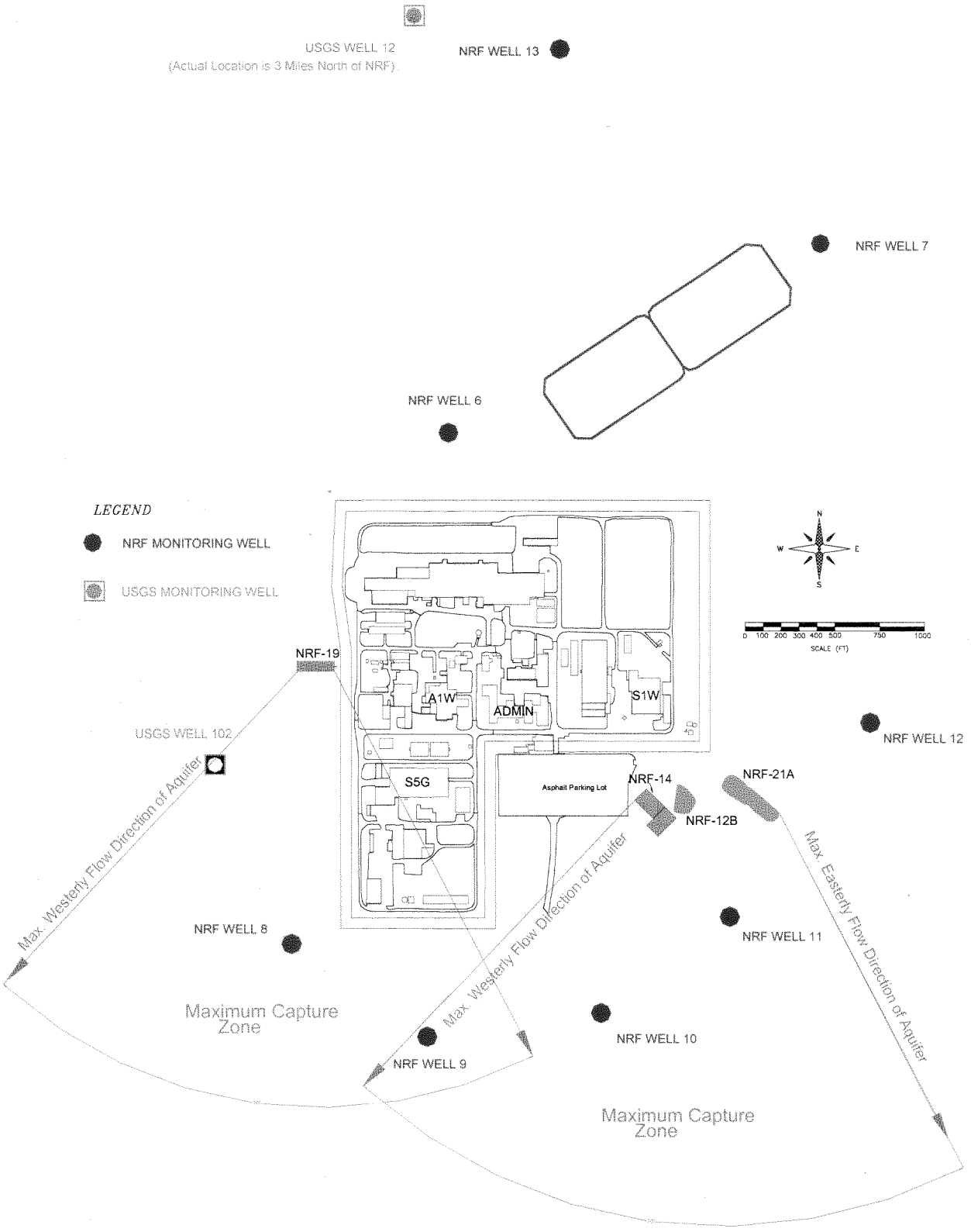


Figure C-3 Groundwater Monitoring Well Locations for Engineered Cover Areas

Data may be transformed to obtain a sampling distribution that is approximately normally distributed and appropriate statistical analysis applied. Non-parametric mean comparison tests are also routine, and will be used if appropriate. Not all data may be suitable for trend analysis. Typically, environmental data contains outliers that, if included in trend analysis, would produce erroneous conclusions. The existence and treatment of outliers will be determined using standard statistical methods.

5.0 Organization and Personnel Responsibilities

The Naval Reactors (NR) organization is ultimately responsible for operating and maintaining the selected remedy for the designated OU 8-08 sites. NR has designated specific duties to Bechtel Bettis, Inc. for the operation and maintenance of these sites. Bechtel Bettis personnel or a Bechtel Bettis subcontractor will perform sample collection, sample analysis, data evaluation, data reporting, site inspections, surveys, maintenance, and any needed repairs at these sites.

Table C-7 below shows collection and reporting details for NRF data that is submitted to the State of Idaho and the EPA.

Table C-7 NRF Data Collection and Reporting

Data Collected	When Collected	When Submitted
Groundwater	Triannually, with sample collection targeted for the months of March, July, and November.	120 days after data collection.
Soil	Annually, targeted for summer season (June – August).	With Institutional Controls Monitoring Report, targeted for submittal in December.
Vegetation	Annually, targeted for summer season (June – August).	With Institutional Controls Monitoring Report, targeted for submittal in December.
Moisture Probe	Monthly the first two years; then quarterly, targeted for February, May, August, and November.	With Institutional Controls Monitoring Report, targeted for submittal in December.
Radiation Survey	Annually, targeted for summer season (June – August).	With Institutional Controls Monitoring Report, targeted for submittal in December.
Inspections	Annually, targeted for summer season (June – August).	With Institutional Controls Monitoring Report, targeted for submittal in December.

Attachment 1

Site Inspection Sheets

Engineered Cover/Landfill Areas/Site Bench Marks

This Page Intentionally Blank

ANNUAL INSPECTION REPORT FORM FOR WAG 8
OPERATIONS AND MAINTENANCE PLAN
Engineered Cover/Landfill Areas/Site Bench Marks
(See RD/RA Operations and Maintenance Plan, Sections 2.1 and 2.2 for Details)

Date_____

	Inspection Activity	NRF-1	NRF-51	NRF-53	NRF-14	NRF-19	NRF-21A	Comments/Recommended Repairs
	SOIL COVER							
1.	Inspect for subsidence areas or slope movement.							
2.	Inspect for large cracks or animal Intrusion.							
3.	Inspect for erosion.							
	VEGETATIVE COVER							
1.	Inspect for non-growth areas.							
2.	Inspect for sparse growth areas.							
3.	Inspect for weed encroachment							
	MISCELLANEOUS STRUCTURES							
1	Inspect signs, fences and gates for damage							
	SITE BENCH MARKS, PADS AND BALLARDS							
1.	Inspect bench mark for abnormalities							
2.	Inspect pads for cracks and deformation.							
3.	Inspect condition of bollards.							

Printed Name of Inspector_____

Signature_____

Photographs Taken? Yes No

If Taken, Number _____

This Page Intentionally Blank

Attachment 2

Site Inspection Sheets

Groundwater, Soil Moisture and Gas

This Page Intentionally Blank

ANNUAL INSPECTION REPORT FORM FOR WAG 8
OPERATIONS AND MAINTENANCE PLAN
Groundwater Monitoring Wells/Moisture Probes/Soil Gas Ports
(See RD/RA Operations and Maintenance Plan, Sections 2.3 and 2.4 for Details)

Date_____

	Inspection Activity	Well or Probe Designator						Comments/Recommended Repairs
	MONITORING WELLS							
1.	Inspect locks.							
2.	Inspect housing.							
3.	Inspect electrical wiring.							
4.	Inspect measuring and discharge lines.							
5.	Inspect concrete pad and bollards.							
	MOISTURE MONITORING NEUTRON PROBES							
1.	Inspect individual access tubes for damage.							
2.	Inspect locks for damage.							
	SOIL GAS MONITORING WELLS							
1	Inspect well casing for signs of damage							
2.	Inspect locks for damage.							
3.	Ensure well is functioning correctly.							
4.	Inspect concrete pads and bollards.							

Printed Name of Inspector_____

Signature_____

Photographs Taken? Yes No

If Taken, Number _____

This Page Intentionally Blank